UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/865,468	05/29/2001	Hisao Yasuhara	109375	3731

25944 7590 08/08/2005

OLIFF & BERRIDGE, PLC
P.O. BOX 19928
ALEXANDRIA, VA 22320

EXAMINER	
CANTELMO, GREGG	

ART UNIT	PAPER NUMBER
1745	

DATE MAILED: 08/08/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No. 09/865,468	Applicant(s) YASUHARA ET AL.	
	Examiner Gregg Cantelmo	Art Unit 1745	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on 19 May 2005.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) 1-8,10,11 and 13-20 is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☐ Claim(s) _____ is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

13 HC

DETAILED ACTION

Response to Amendment

1. In response to the amendment received May 19, 2005:

   a. Claims 1-8, 10-12 and 13-20 are pending;

   b. The previous 112 rejections have been withdrawn in light of the amendment.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

Claims 13, 14, 17, 18 and 20 are rejected under 35 U.S.C. 103(a) as being unpatentable over JP 11-316220 A (JP '220) in view of U.S. patent No. 6,158,384 (Ye).

JP '220 discloses a pretreatment apparatus and method of operating comprising: a cathode 2 for holding a metal sample, anodes 5 (top and bottom of the chamber 4, separated by the cathode section 2) arranged to counter cathode 2, a pretreatment chamber 4 having means for removing contaminants on the surface of the metal sample by sputtering, a reaction chamber 15 connected to the pretreatment chamber having means for heating the metal sample and means for detecting trace elements given off by the heated metal sample (Fig. 1 as applied to claims 13, 14, 17 and 20).

A reaction chamber 15 is connected to the pretreatment chamber through a shutter for heating the metal sample and a detector for detecting trace elements given off by the heated sample (Fig. 1 as applied to claim 18).

The difference between claims 13, 14, 17 and 20 and JP '220 is that JP '220 does not disclose of means for cooling at least one electrode for sputtering.

Yet another drawback associated with the conventional inductively coupled reactor involves the cooling of the walls of the chamber. Most processes typically are only stable and efficient if the chamber temperature is maintained within a narrow range. Since the formation of the plasma generates heat which can raise the chamber temperature above the required narrow range, it is desirable to remove heat from the chamber in order to maintain an optimum temperature within the chamber. This typically is accomplished by flowing coolant fluid through cooling channels formed within the conductive portion of the chamber wall. As it is not easy to form cooling channels within the insulative portion of the chamber walls, air is directed over the exterior of these walls. A problem arises in that the electrically insulative materials, such as quartz or ceramic, typically used to form the chamber walls also exhibit a low thermal conductivity. Thus, the chamber walls are not ideal for transferring heat from the chamber. As a result, the chamber temperature tends to fluctuate more than is desired in the region adjacent the insulative chamber walls because the heat transfer from the chamber is sluggish. Often the temperature fluctuations exceed the aforementioned narrow range required for efficient etch processing (Ye, col. 3, ll. 22-50).

The preferred embodiments of the present invention also provide conductive chamber walls to further improve workpiece processing. An advantage of placing the antennas within the processing chamber is that it allows the size of the electrically conductive portion of the chamber walls, which acts as an anode for the DC bias circuit, to be increased. Providing a larger anode allows processing rates to be optimized while not creating significant damage to the workpiece (Ye, col. 6, ll. 30-39).

Chamber walls made of a conductive metal such as aluminum would also exhibit significantly greater thermal conductivity than that of conventionally employed electrically insulative materials such as quartz or ceramic. This results in a quicker transfer of heat from the antenna and the interior of the chamber to coolant fluid flowing through cooling channels formed in the chamber walls. Therefore, it is easier to maintain a narrow chamber temperature range and avoid the problems of a conventional reactor in connection with the cracking and flaking off of deposits from the chamber walls. Additionally, it is easier and less expensive to form cooling channels in aluminum chamber walls than in the conventional quartz walls (Ye, paragraph bridging columns 6 and 7).

Yet another advantage of employing conductive chamber walls 220 & 240 is the enhanced cooling capability such walls can afford. For example, chamber walls made of aluminum exhibit a much higher thermal conductivity in comparison to the quartz walls of conventional inductively coupled plasma etch reactors (e.g. 204 W/mK for aluminum compared with 0.8 W/mK for quartz). In addition, as cooling channels 216 (shown in FIGS. 7A-8B) are easily formed in aluminum chamber walls 212 and the

entire chamber can now be made of aluminum, coolingchannels 216 can be distributed throughout the chamber walls. This eliminates the need for air cooling the exterior of the chamber walls as was necessary with a conventional inductively coupled RF plasma reactor. Flowing coolant through internal cooling channels 212 is a much more efficient method of heat transfer. Consequently, heat transfer from the chamber 400 to coolant fluid flowing in the cooling channels 216 formed in the chamber walls 212 is much quicker. This increased rate of heat transfer allows for much less variation in the chamber temperature. As a result, the chamber temperature can be readily maintained within that narrow range necessary to ensure efficient etch processing and to prevent the cracking and flaking off of contaminating deposits from the chamber walls (Ye, col. 11, ll. 16-38).

Thus the anode chamber walls are taught by Ye to further include cooling means to prevent any contaminants from the chamber walls from flaking off of the anode chamber walls and onto the substrate being processed.

Therefore it would have been obvious to one of ordinary skill in the art at the time the claimed invention was made to modify the teachings of JP '220 by cooling the anode chamber walls of JP '220 as taught by Ye since it would have prevented any contaminants from the chamber walls from flaking off of the anode chamber walls and onto the substrate being processed.

2. Claims 3, 6, 15 and 16 are rejected under 35 U.S.C. 103(a) as being unpatentable over JP 11-316220 A (JP '220) in view of U.S. patent No. 6,158,384 (Ye) and JP 04-276062 A (JP '062).

JP '220 discloses a pretreatment apparatus and method of operating comprising: a cathode 2 for holding a metal sample, anodes 5 (top and bottom of the chamber 4, separated by the cathode section 2) arranged to counter cathode 2, a pretreatment chamber 4 having means for removing contaminants on the surface of the metal sample by sputtering, a reaction chamber 15 connected to the pretreatment chamber having means for heating the metal sample and means for detecting trace elements given off by the heated metal sample (Fig. 1 as applied to claim 15). The top and bottom portions of the chamber, separated by the opposing electrode section 2 surrounds the sample (as applied to claim 16). A reaction chamber 15 is connected to the pretreatment chamber through a shutter for heating the metal sample and a detector for detecting trace elements given off by the heated sample (Fig. 1 as applied to claim 15).

The sample is at a side of the holder and the opposing electrodes face the sample (claim 3).

The differences between claims 15 and JP '220 are that JP '220 does not disclose of using an arc etching process wherein the sample is the anode and the surrounding electrodes are the cathode (claim 15).

Yet another drawback associated with the conventional inductively coupled reactor involves the cooling of the walls of the chamber. Most processes typically are only stable and efficient if the chamber temperature is maintained within a narrow range. Since the formation of the plasma generates heat which can raise the chamber temperature above the required narrow range, it is desirable to remove heat from the chamber in order to maintain an optimum temperature within the chamber. This

typically is accomplished by flowing coolant fluid through cooling channels formed within the conductive portion of the chamber wall. As it is not easy to form cooling channels within the insulative portion of the chamber walls, air is directed over the exterior of these walls. A problem arises in that the electrically insulative materials, such as quartz or ceramic, typically used to form the chamber walls also exhibit a low thermal conductivity. Thus, the chamber walls are not ideal for transferring heat from the chamber. As a result, the chamber temperature tends to fluctuate more than is desired in the region adjacent the insulative chamber walls because the heat transfer from the chamber is sluggish. Often the temperature fluctuations exceed the aforementioned narrow range required for efficient etch processing (Ye, col. 3, ll. 22-50).

The preferred embodiments of the present invention also provide conductive chamber walls to further improve workpiece processing. An advantage of placing the antennas within the processing chamber is that it allows the size of the electrically conductive portion of the chamber walls, which acts as an anode for the DC bias circuit, to be increased. Providing a larger anode allows processing rates to be optimized while not creating significant damage to the workpiece (Ye, col. 6, ll. 30-39).

Chamber walls made of a conductive metal such as aluminum would also exhibit significantly greater thermal conductivity than that of conventionally employed electrically insulative materials such as quartz or ceramic. This results in a quicker transfer of heat from the antenna and the interior of the chamber to coolant fluid flowing through cooling channels formed in the chamber walls. Therefore, it is easier to maintain a narrow chamber temperature range and avoid the problems of a

conventional reactor in connection with the cracking and flaking off of deposits from the chamber walls. Additionally, it is easier and less expensive to form cooling channels in aluminum chamber walls than in the conventional quartz walls (Ye, paragraph bridging columns 6 and 7).

Yet another advantage of employing conductive chamber walls 220 & 240 is the enhanced cooling capability such walls can afford. For example, chamber walls made of aluminum exhibit a much higher thermal conductivity in comparison to the quartz walls of conventional inductively coupled plasma etch reactors (e.g. 204 W/mK for aluminum compared with 0.8 W/mK for quartz). In addition, as cooling channels 216 (shown in FIGS. 7A-8B) are easily formed in aluminum chamber walls 212 and the entire chamber can now be made of aluminum, coolingchannels 216 can be distributed throughout the chamber walls. This eliminates the need for air cooling the exterior of the chamber walls as was necessary with a conventional inductively coupled RF plasma reactor. Flowing coolant through internal cooling channels 212 is a much more efficient method of heat transfer. Consequently, heat transfer from the chamber 400 to coolant fluid flowing in the cooling channels 216 formed in the chamber walls 212 is much quicker. This increased rate of heat transfer allows for much less variation in the chamber temperature. As a result, the chamber temperature can be readily maintained within that narrow range necessary to ensure efficient etch processing and to prevent the cracking and flaking off of contaminating deposits from the chamber walls (Ye, col. 11, ll. 16-38).

Thus the anode chamber walls are taught by Ye to further include cooling means to prevent any contaminants from the chamber walls from flaking off of the anode chamber walls and onto the substrate being processed.

Therefore it would have been obvious to one of ordinary skill in the art at the time the claimed invention was made to modify the teachings of JP '220 by cooling the anode chamber walls of JP '220 as taught by Ye since it would have prevented any contaminants from the chamber walls from flaking off of the anode chamber walls and onto the substrate being processed.

With respect to reversing the electrode potentials of JP '220:

JP '062 discloses a cathodic arc plasma apparatus wherein the apparatus employs arc discharge cleaning from plural cathode sources disposed about steel workpieces

The motivation for using arc discharge etching is that it provides an improved cleaning the surface of a substrate.

Therefore it would have been obvious to one of ordinary skill in the art at the time the claimed invention was made to modify the teachings of JP '220 by using the arc cleaning arrangement of JP '062 since it would have improved the cleaning of the surface of the substrate.

With respect to claim 6:

Claims 3 and 15 are drawn to an apparatus. The limitations of claim 6 are not held to further limit the apparatus because they recite limitations as to the analysis step.

The sample is not a positive component of the apparatus nor are the contaminants analyzed. Therefore claim 6 does not impart further structure to claim 3.

While intended use recitations and other types of functional language cannot be entirely disregarded. However, in apparatus, article, and composition claims, intended use must result in a structural difference between the claimed invention and the prior art in order to patentably distinguish the claimed invention from the prior art. If the prior art structure is capable of performing the intended use, then it meets the claim. In a claim drawn to a process of making, the intended use must result in a manipulative difference as compared to the prior art. In re Casey, 370 F.2d 576, 152 USPQ 235 (CCPA 1967); In re Otto, 312 F.2d 937, 938, 136 USPQ 458, 459 (CCPA 1963).

Claims directed to apparatus must be distinguished from the prior art in terms of structure rather than function. In re Danly, 263 F.2d 844, 847, 120 USPQ 528, 531 (CCPA 1959). See also MPEP § 2114.

The manner of operating the device does not differentiate an apparatus claim from the prior art. A claim containing a "recitation with respect to the manner in which a claimed apparatus is intended to be employed does not differentiate the claimed apparatus from a prior art apparatus" if the prior art apparatus teaches all the structural limitations of the claim. Ex parte Masham, 2 USPQ2d 1647 (Bd. Pat. App. & Inter. 1987).

It should be noted thought that JP '220 does teach that the sample is then analyzed for trace elements including carbon, oxygen, nitrogen and sulfur (prior art claim 1 as applied to claim 6).

3. Claims 19 and 1, 2, 4, 5 and 7-11 are rejected under 35 U.S.C. 103(a) as being unpatentable over JP 11-316220 A (JP '220) in view of U.S. patent Nos. 6,158,384 (Ye) and 4,624,214 (Suzuki).

JP '220 discloses a pretreatment apparatus and method of operating comprising: a cathode 2 for holding a metal sample, anodes 5 (top and bottom of the chamber 4, separated by the cathode section 2) arranged to counter cathode 2, a pretreatment chamber 4 having means for removing contaminants on the surface of the metal sample by sputtering, a reaction chamber 15 connected to the pretreatment chamber having means for heating the metal sample and means for detecting trace elements given off by the heated metal sample (Fig. 1 as applied to claims 19). A reaction chamber 15 is connected to the pretreatment chamber through a shutter for heating the metal sample and a detector for detecting trace elements given off by the heated sample (Fig. 1 as applied to claim 19).

The process removes contaminants from the surface of the metal sample by sputtering (as applied to claim 1).

The metal sample is at the side of the holder and plural anodes 5 face the sample (as applied to claim 2).

The sample is then analyzed for trace elements including carbon, oxygen, nitrogen and sulfur (prior art claim 1 as applied to claims 4 and 5).

The analyzing chamber performs one of fusion analysis or combustion analysis (as applied to claims 7, 8, 10 and 11).

The difference between these claims and JP ‘220 is that JP ‘220 does not disclose of means for cooling at least one electrode for sputtering at a temperature of 50degrees C or less.

With respect to the cooling step:

Yet another drawback associated with the conventional inductively coupled reactor involves the cooling of the walls of the chamber. Most processes typically are only stable and efficient if the chamber temperature is maintained within a narrow range. Since the formation of the plasma generates heat which can raise the chamber temperature above the required narrow range, it is desirable to remove heat from the chamber in order to maintain an optimum temperature within the chamber. This typically is accomplished by flowing coolant fluid through cooling channels formed within the conductive portion of the chamber wall. As it is not easy to form cooling channels within the insulative portion of the chamber walls, air is directed over the exterior of these walls. A problem arises in that the electrically insulative materials, such as quartz or ceramic, typically used to form the chamber walls also exhibit a low thermal conductivity. Thus, the chamber walls are not ideal for transferring heat from the chamber. As a result, the chamber temperature tends to fluctuate more than is desired in the region adjacent the insulative chamber walls because the heat transfer from the chamber is sluggish. Often the temperature fluctuations exceed the aforementioned narrow range required for efficient etch processing (Ye, col. 3, ll. 22-50).

The preferred embodiments of the present invention also provide conductive chamber walls to further improve workpiece processing. An advantage of placing the

antennas within the processing chamber is that it allows the size of the electrically conductive portion of the chamber walls, which acts as an anode for the DC bias circuit, to be increased. Providing a larger anode allows processing rates to be optimized while not creating significant damage to the workpiece (Ye, col. 6, ll. 30-39).

Chamber walls made of a conductive metals such as aluminum would also exhibit significantly greater thermal conductivity than that of conventionally employed electrically insulative materials such as quartz or ceramic. This results in a quicker transfer of heat from the antenna and the interior of the chamber to coolant fluid flowing through cooling channels formed in the chamber walls. Therefore, it is easier to maintain a narrow chamber temperature range and avoid the problems of a conventional reactor in connection with the cracking and flaking off of deposits from the chamber walls. Additionally, it is easier and less expensive to form cooling channels in aluminum chamber walls than in the conventional quartz walls (Ye, paragraph bridging columns 6 and 7).

Yet another advantage of employing conductive chamber walls 220 & 240 is the enhanced cooling capability such walls can afford. For example, chamber walls made of aluminum exhibit a much higher thermal conductivity in comparison to the quartz walls of conventional inductively coupled plasma etch reactors (e.g. 204 W/mK for aluminum compared with 0.8 W/mK for quartz). In addition, as cooling channels 216 (shown in FIGS. 7A-8B) are easily formed in aluminum chamber walls 212 and the entire chamber can now be made of aluminum, coolingchannels 216 can be distributed throughout the chamber walls. This eliminates the need for air cooling the exterior of

the chamber walls as was necessary with a conventional inductively coupled RF plasma reactor. Flowing coolant through internal cooling channels 212 is a much more efficient method of heat transfer. Consequently, heat transfer from the chamber 400 to coolant fluid flowing in the cooling channels 216 formed in the chamber walls 212 is much quicker. This increased rate of heat transfer allows for much less variation in the chamber temperature. As a result, the chamber temperature can be readily maintained within that narrow range necessary to ensure efficient etch processing and to prevent the cracking and flaking off of contaminating deposits from the chamber walls (Ye, col. 11, ll. 16-38).

Thus the anode chamber walls are taught by Ye to further include cooling means to prevent any contaminants from the chamber walls from flaking off of the anode chamber walls and onto the substrate being processed.

Therefore it would have been obvious to one of ordinary skill in the art at the time the claimed invention was made to modify the teachings of JP '220 by cooling the anode chamber walls of JP '220 as taught by Ye since it would have prevented any contaminants from the chamber walls from flaking off of the anode chamber walls and onto the substrate being processed.

With respect to cooling at 50degrees C or less:

Suzuki discloses lowering the surface temperature of the inner wall of the evacuatable chamber or by covering the inner wall of the evacuatable chamber with a cooled member. In other words, the present invention is based on the finding that the probability of reflection of particles from the surface of a substance placed in an

evacuatable chamber and, also, the probability of desorption of atoms and molecules adsorbed to the surface of the substance can be reduced by lowering the surface temperature of the substance (col. 3, ll. 24-35).

The coolant to the surrounding components is liquid nitrogen which will obviously cool the elements to a temperature below 50degrees C (col. 3, ll. 1-20 and col. 5, ll. 27-35).

Suzuki teaches that the probability of desorption of atoms and molecules adsorbed to the surface of the substance can be reduced by lowering the surface temperature of the substance. This reduction in temperature is achieved via a liquid nitrogen refrigerant. Such a refrigerant will obviously impart cooling temperatures of about 50degrees C or less on these components, thereby reducing the contamination of the workpiece in the chamber.

Therefore it would have been obvious to one of ordinary skill in the art at the time the claimed invention was made to modify the teachings of JP '220 in view of Ye and Suzuki by cooling the anode chamber portion of the processing chamber with a liquid nitrogen refrigerant since it would have enhanced the purity of the workpiece being processed in the etch system and process of JP '220.

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Gregg Cantelmo whose telephone number is (571) 272-1283. The examiner can normally be reached on Monday to Thursday from 9 a.m. to 6 p.m. If attempts to reach the examiner by telephone are unsuccessful, the examiner's

supervisor, Pat Ryan, can be reached on (571) 272-1292. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306. FAXES received after 4 p.m. will not be processed until the following business day. Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

Gregg Cantelmo
Primary Examiner
Art Unit 1745

gc Gregg Canto

August 4, 2005